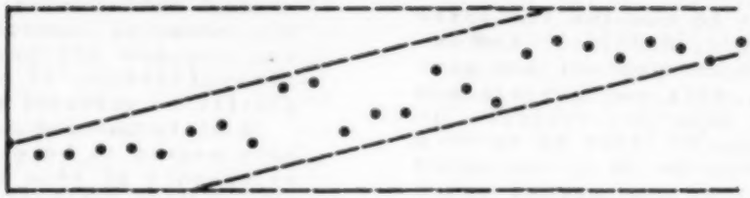
INDUSTRIAL QUALITY CONTROL



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THE SOCIETY OF QUALITY CONTROL ENGINEERS

QUALITY CONTROL: A TOOL OF MANAGEMENT

Management's job is to combine the three productive factors: men, machines, and materials so as to maximize product and minimize cost. However, this maximum-minimum combination has a very important codicil. It is quality as well as quantity that is to be a maximum and the cost that is to be minimized is a competitive cost in the market place rather than the standard cost of the cost accountant. Therefore the task would appear to be to employ the three productive factors in a manner that will lead to the highest quantity of product of a quality that will meet with market approval, and at a cost which will at least not exceed the costs of competing firms and preferably will be lower than those costs.

There are four distinct ideas here: quantity, quality, market approval, cost. The four are closely interrelated in any manufacturing operation and most of the complications that make up the management problem grow out of these interrelations. It is balance between these ideas that management seeks when it aims at achieving the best combination in the use of the three factors of production. How does the search proceed? The formula is about as follows:

a. design it correctly
b. purchase the quality of material required
c. machine it according to design
d. assemble it according to plan
e. market it so as to meet consumer approval
f. price it so as to meet competitive costs

Management aims to implement the elements of this formula by all the devices which it can command. Through the years a proliferation of such devices have become available. Most of these have been helpful, but not all of them have been efficient in the sense that they have contributed to the management problem in proportion to their cost in energy and money.

Now a new aid to management, Statistical Quality Control, is becoming generally available. Let us examine the relation of the new aid to the elements of the management formula.

Quality Control records give to design engineering information on the tolerances that can be held during machine operations with existing equipment, information on the failure of mating pieces to assemble as designed, information on the ability of vendors and subcontractors to hold dimensions and tolerances set up by the purchasing plant's design department, information on tolerances required in the design which are non-essential in the functioning of the product. In the design of new product Quality Control records will show relative advantages of alternate designs, and may show that one design is feasible with existing equipment whereas another design is not.

Quality Control methods provide a definite guarantee that materials received will meet the purchase specifications. Scientific sampling plans protect the purchaser from accepting poor quality material, protect the vendor from rejection of good quality material, serve notice quickly of quality variation on the part of the vendor, reduce the cost of operating the receiving inspection department through routinizing operations and reducing the volume of inspection. Receiving inspection records aid purchasing by providing a classification of vendors on the basis of quality of material presented.

Quality Control methods in the machine shop have proved to be one of the outstanding developments of this war. Foremen and supervisors have learned that scrap is not necessary, that salvage departments can gradually approach the vanishing point, that rework and repair need not add a major increment to production cost, that quality is not inconsistent with quantity, that it is easier to control a process so that it conforms to the design than to be continually harrassed by deviations, exceptions, or design changes. Machine shops that have learned how to control excessive variability and to take corrective action on assignable causes of variability are reaping a golden harvest in the form of lower unit costs, ability to meet production schedules, and better relations within the shop, with inspection, and with other plant functions.

Quality Control sets standards in assembly and catalogs the quality of the work by recording types of faults, location of faults, repetitive character of faults.

Quality Control results in a product in which the sales force can have full confidence because they know that the quality warranty is based on precise factory knowledge. Customer quality complaints will approach the vanishing point when products are turned out under conditions of full statistical control.

Quality Control procedure carries almost unlimited promise of cost reduction. More process information leads to improved design which eliminates wastes in production. Scientific sampling plans lead to direct reduction of costs in receiving inspection. Better quality in the receiving crib reduces cost of handling defectives in fabrication and assembly. Reduction of scrap, salvage, rework and repair lowers unit costs of production. Greater output of good parts without additional equipment or manpower also lowers unit costs. Reduction of assembly time through better fits, less defectives to replace, and the elimination of faulty work in assembly all point to lower costs. A plant that applies Statistical Quality Control can meet competitive costs.

TOP MANAGEMENT VIEWS QUALITY CONTROL

M. Herbert Eisenhart, President
Bausch and Lomb Optical Company

This address was presented at the luncheon meeting which opened the First Quality Control Clinic sponsored jointly by the Rochester Quality Control Engineers and the Industrial Management Council of Rochester.

A number of years ago when I first came to Rochester, I recall two slogans which were very prominent at the approaches to the city. There were large signs, on some of which were the words "Rochester-Where Quality Predominates" and on others "Rochester-made Means Quality". These advertising terms were not just catch phrases to lure the interest of the passing motorist or passenger. They were, on the other hand, basically descriptive of an inherent objective of the people and at the same time quite aptly descriptive of the manufacturing establishments of this city. A listing of the varied manufacturers of Rochester reads like an honor role of those concerns where quality does really predominate. One can look over, for example, the equipment of a modern warship. And probably nowhere is there a greater concentration of our economic and material life; and in almost every department of this complicated structure one finds washing machines, dental equipment, sterilizers, microscopes, photographic supplies, telephones and radio, thermometers, complicated machinery, fire control equipment, as well as many others. And what does the name plate say? Many, many times you will see "Made in Rochester". The presence of these Rochester made products is indicative of the high quality of the products, for a modern battlewagon of the United States is the very acme of perfection in every respect.

I, of course, have just selected this particular example as a place where the requirements call for quality products, and fortunately this same condition obtains in many walks of life where a consciousness and a respect for real quality and perfect performance does predominate.

And so it is particularly appropriate, it seems to me, that this group should be gathered together here, today, in our city, for the conduct of this Quality Control Clinic. It is quite appropriate, too, that this activity should be taking place in these surroundings, and the size of this group is indicative of a desire to carry on many of these newer techniques which can make a contribution in the direction of improving further quality control as a function of manufacture.

There is another significant feature in connection with this meeting to which I would like to call your attention, and that is, the fact that this group, newly formed, is affiliated with the Industrial Management Council. Now it has been my privilege to have had a very intimate relationship with this organization for a considerable number of years and I am sure this affiliation is indicative once again of the broad-minded approach which those at the head of the Industrial Management Council have, looking to the ever-increasing evolution of the job of industrial management. From time to time the General Managers' Group has seen fit to add new divisions, thereby increasing the effective coverage of the field of business management and at the same time stimulating interest among a widening circle in the broad problems of effective management. This Quality Control Group, I am sure, will take its position along side of its kindred groups, such as supervision, production control, employment, industrial relations, and others which have already been organized and are an inherent part of the Council. Here then is a favorable climate and a going organization into which this new activity can be fitted and I am sure, with proper, sound, and practical leadership, you will find the hearty and cooperative assistance of top management among a group of industries to whom the concept of quality is not new.

Of course, quality control in its basic consideration presupposes an attitude of management definitely interested in the quality of product produced. In other words, any manufacturing establishment can carry on its production program by depending upon the individual workmen to do a good job and so can, generally speaking, have available for public use products of quite a satisfactory quality. This is a condition which is very apt to obtain with the inception of a new business-somebody determines that there is a field for a product and the manufacture of this product is started in a small, easily controlled manner. When the business grows, however, and the number

INDUSTRIAL QUALITY CONTROL

of people involved becomes greater, any management concerned with the maintenance of quality standards must find ways and means to safeguard this important concept. It is at this stage in the evolution of the business that quality consciousness on the part of management must play a very important role and it is to meet this situation that some technique for the control of quality must have important consideration. With the changing personnel in any factory organization, the quality concept must be constantly emphasized in order to maintain the predetermined specifications of the finished product. As we look back over the last twenty-five years, I think it is safe to say that production for war purposes in many lines of manufacture has forced upon management a much more effective consciousness of this maintenance of quality standards.

In World War I, many plants were brought face to face for the first time with the standards of effective performance on the part of many products for war purposes. Subsequent to that war, much time was spent in both the War and Navy Departments in the consideration of new and improved material. And in the intervening years as we came into World War II, there had been developed very extensive manufacturing specifications for all kinds of war equipment, and with these had also been developed very important final specifications of inspection. I doubt if any circumstance or any condition involving the American manufacturer has been more effective in bringing about not only this consciousness, but obviously as a consequence the necessity of ways and means to safeguard the quality of the final product.

The maintenance of quality, I have always felt, is a matter of habit and I am sure that the greatest detrimental factor to the maintenance of the reputation for quality on the part of any business is a slovenly attitude on the part of the management, through superintendent, foreman, supervisor, etc. For this maintenance of quality standards, the entire organization must be constantly imbued with the habit of accuracy and thoroughness. Anything less than this is bound to lead to a minimum of good quality and the standards of any manufacturing plant are bound to suffer where supervision is allowed to become lax in its direction of the individual manufacturing operations.

I have been attempting to emphasize the importance of the quality concept as regards the soundness of any manufacturing organization and while this may seem axiomatic, the fact remains that in order to give wholehearted consideration to the question of quality control, such procedure presupposes and is dependent upon the proper attitude of top management. And so on this foundation, let us proceed to the consideration of how quality control should function. This recently developed function, I believe, should be looked upon as one of the most effective tools for the handling of the job of management.

It is very interesting as one studies the evolution of American Private Enterprise to visualize the introduction successively of new controls. I suppose one can go back more than one hundred and fifty years when Eli Whitney first undertook his contract for 12,000 muskets for our own U.S. Army. He took this contract at a very low figure, and, confronted with the obligation of delivery, he is credited with the first consideration of the use of interchangeable parts on a contract involving mass production. The story of how he accomplished this interchangeability sounds simple to us now, but as a matter of fact it was a revolutionary procedure in production methods. He, of necessity, was forced to concern himself with quality, but I am thinking of his pioneering work from another angle. Ever since his time management has developed one after another of these revolutionary concepts and from time to time out of these concepts has developed important, continuing useful tools of management. We have had, for example, the evolution of the basic specifications in engineering in modern manufacturing establishments. We have later had the constant control of inventories; we have had the application of the principles of scientific management, demonstrating primarily the importance of line and functional organization; we have had the evolution and the resultant importance of cost analysis and cost controls; and in recent years we have had the constant perfecting of budgetary control in the complete functioning of a business. I could mention many more phases of this management evolution and yet I am sure you who are gathered here will realize the importance of this new tool in the hands of efficient management.

American industry needs all these refine-

ments, realizing at all times that each one must justify its existence in the ultimate cost of the product. Quality control can meet this requirement even if it minimizes to a relatively small extent the production of scrap or other unsatisfactory product. I have never had any doubt in my mind that an effectively operated quality control procedure will unquestionably justify the necessary expense. I believe then that quality control must be predicated in the first place on a comprehensive inspection program for the elements entering into the final product.

Quality control is a tool obviously of top management and serves as the means of knowing how the finished product is being produced. Those actually in the manufacturing operations must do their job which means production to specified standards.

And so I cannot help but feel that quality of performance on an individual machine is a definite obligation of the immediate supervisor in any particular department. The quality of individual part manufacture is a problem which, generally speaking, can be quite accurately determined by the Engineering Department with tolerances given to the individual operator. As the inherent parts of manufacture are brought together into subassemblies and final assembly, there enters, however, the consideration of top management for the performance of the finished product.

Quality control for top management involves on the one hand, the functioning of the finished product against a background of perfect performance and absolutely perfect workmanship, and on the other, the relative quality of the product of competition. This phase of the problem is one which, it seems to me, requires the consideration of a member of the organization quite apart from the actual manufacturing responsibility. The careful appraisal of the finished product as it is ready to leave the factory requires the judgment of some broad-minded individual who is constantly in touch not only with the competitor's product, how it looks and how it functions, but also has before him constantly the complaints and observations of the customers who are using the products of the plant. In the last analysis, the ultimate consumer is the boss who determines what a plant will manufacture and whether its product is acceptable. It seems to me that top management must be concerned with and be constantly in touch with this viewpoint as determined by the quality control engineer. It is this appraisal of the performance of the finished product, as interpreted by the engineer, involving the reactions of the ultimate consumer which is of prime importance to top management. In order to make this quality control function of any business most effective, it is my belief that the determination of final inspection standards against which quality control records are kept is a function of the Engineering Division of the business. In other words, the standards of final inspection should be determined when the product is initially designed and at this point these various considerations can and should be taken into account.

I should like here to pay my respects to the great stimulus given to this whole question of quality control by the recent use of statistical methods. When I say recent, I am talking of course, in relative terms, for I am told that this initial consideration by use of a quality control chart was first introduced in 1924 by W.A. Shewhart. During your session here today, you will no doubt discuss in some detail the advantages accruing from this method of procedure. I am sure, however, we are all tremendously interested in any technique which will ultimately reduce the percentage of defective work and for the accomplishment of which accurate and effective quality data furnishes the necessary control. There is much that could be said concerning the development of this statistical procedure, and no doubt out of this we will find increasing effectiveness in our aim of maintaining quality standards. To me the real gain from this new concept is in the assistance which the use of these methods will give in the maintenance of quality, and in the sound protection and justification for the expenditures involved in the various phases of quality control. In the last analysis, all these tools of management must justify themselves from the cost angle and anything that will minimize scrap, that will make the productive labor more definitely effective, and at the same time produce product of a satisfactory quality, will be a great boon to top management.

It seems to me then that quality control, standing definitely in line with the other primary tools of management, offers the ways and means for another safeguard for the Private Enterprise system in our American economy.

(Continued on Page 14)

be as follows:

$p_s = 5\%$, $\bar{p} = 1\%$, to apply to pieces failing in

MULTIPLE CHARACTERISTICS AS RELATED TO SAMPLING[1]

Vernon R. Grom, Section Head
Statistical Quality Control
Curtiss-Wright-Buffalo Plant

One of the major sampling problems confronting Quality Control Operators today is the design of acceptance standards for parts which must be inspected for multiple characteristics. Due to the complex nature, and variety of installations involved in the construction of the C-46 "Commando" Cargo Airplane, sampling of parts containing several characteristics has been a major problem in receiving inspection at Curtiss-Wright. The following discussion is presented in the interest of those who are concerned with this particular phase of Quality Control.

There are two major sampling inspection plans in operation at the Buffalo Plant, the first based on the Single and Double Sampling Inspection Tables developed by Harold F. Dodge, Quality Results Engineer, and Harry G. Romig, member of the Technical Staff, Bell Telephone Laboratories, New York City; the second based on multiple sampling. Other acceptance plans now in use have been developed by the Statistical Quality Control Section to cover specialized problems.

The objectives of sampling inspection at Curtiss-Wright are to promote efficient operation of the receiving department, to improve quality, to increase production, and to reduce costs. Quality is improved by determination of the process average percent defective of each supplier. This information is reported to the Purchasing Department in the form of a comprehensive, "Vendor Classification", which provides the basis of action for better quality, discontinuance of contracts with non-cooperative suppliers, and the study of rejection percentages for all of the articles supplied by an individual vendor so that the Purchasing Department can rearrange the contracts of such vendor to permit him to concentrate on high quality items, and to discontinue production of poor quality items. Quality loss caused by the fatigue factor is checkmated through the medium of scientific selection of small, but representative samples, so that objective rather than quantitative inspection will be realized. Production is increased by eliminating hold-ups in receiving operations, and by lessening production difficulties due to excessive handling of materials, a factor which invariably results in material distortion, as for example; in the case of bent tubing which later creates flaring difficulties, due to out of round condition of the tubing. Inspection costs are reduced through the medium of sampling methods, and production costs are reduced through expedited disposition of incoming materials.

In dealing with the problem of multiple characteristics, the prime consideration is; what will reject the part? If failure of any one of a number of characteristics will reject the part, then the whole piece must be rejected. On the other hand, if the characteristics are non-related, then each characteristic can be sampled individually. In Figure I dimension "B" must be concentric with dimension "A", therefore, dimensions "A" and "B" must be considered collectively. Conversely - Figure II shows a unit with a tubular attachment. Failure of the tube (A) would not justify rejection of the unit (B). This item, therefore, contains non-related characteristics which can be sampled individually. While this is an elementary consideration, very frequently complicated sampling problems arise which can be dealt with only when one fully understands these fundamental considerations.

One of the advantages of recording the number of defects for each characteristic is that, if a lot of material fails the sample, and the material is urgently needed to keep production going, it is only necessary to detail the lot for those characteristics which failed the sample acceptance number.

Suppose that piece parts are to be inspected for six characteristics. It has been determined that a lot tolerance of 5% (p_t = 5%) will be acceptable and that about 1% ($\bar{p}$ = 1%) of the vendor's material is defective. Thus for a lot of 6000 pieces the sample size will be 185 and the acceptance number will be 5. (Dodge Romig Table, Lot Quality Protection, Single Sampling). Let the inspection record

1. The writer wishes to express a debt of gratitude to Mr. H.F. Dodge for assistance through numerous suggestions and reading the manuscript of this article. Nevertheless responsibility for the accuracy of the content rests solely with the author.

be as follows:

Characteristics	A	B	C	D	E	F	Total No. of Defects
No. of Defects	4	8	5	4	5	4	30

The problem of the Quality Control Engineer may be stated as follows: Is the lot acceptable on Characteristics A, C, D, E, and F, but rejectable on characteristic B? Is the lot rejectable because the total number of defectives exceeds 5? The answer depends entirely on what was intended at the initial step of selecting $p_t = 5\%$. If this figure were intended to be applicable to each characteristic separately, the answer to the first question would be in the affirmative. The lot would require to be detailed with respect to characteristic B only. This is fairly loose inspection and should be recognized as such when it is employed. If the inspection plan contemplated that an acceptable lot should produce a sample containing not more than five defective pieces or defects (assuming that inspection ceases when a defect is found), the answer to the second question would be in the affirmative. This obviously is much tighter inspection.

The reader will recognize that the plan which should actually be used for this case probably lies somewhere between these two extremes, depending always on the purpose of the inspection as expressed in $p_t = 5\%$. This point requires further elaboration.

When defects are treated collectively i.e. the position is taken that the presence of a defect in any one dimension produces a defective piece, then consideration must be given to the effect of this decision on the selection of an applicable page and column of the Dodge-Romig Tables. If the Quality Control Engineer has determined that for a certain part he can afford to accept one lot in ten of material which is 5% defective, assuming that each characteristic is treated separately in applying the Table and that the material is about 1 per cent defective on arrival, then the average quality of this material in the receiving crib is from 1 per cent to 1.5 percent defective with respect to each characteristic. This could mean that with six independent characteristics as many as 6 percent to 9 percent of these pieces would fail to assemble. This is not satisfactory. Clearly the Quality Control Engineer intends the condition, $p_t = 5\%$, $\bar{p} = 1\%$, to apply to pieces failing in assembly, i.e., he expects not more than 1.5 percent of the pieces to be rejected in assembly. Hence this conclusion: If defects are considered collectively the conditions, $p_t = 5\%$, $\bar{p} = 1\%$, will produce a desired result of not more than 1.5 percent assembly rejections. On the other hand, when characteristics are treated separately in the inspection plan it must be assumed that the defective pieces will be additive (this assumption is not warranted to the extent that poor workmanship tends to be contageous), and in order to assure the desired protection the acceptance conditions, $p_t = 2\%$, $\bar{p} = .2\%$, would probably be applicable to each characteristic.

In line with this argument we recognize three distinct cases in our receiving inspection operations, two concerned with piece parts and one with subassemblies. In dealing with piece parts there are many examples in which the several characteristics are either functionally or structurally related and failure of any one will reject the piece. Opposite to this first case are other items making up the second case in which the several characteristics are independent. With subassemblies the characteristics usually apply to parts which are separable and are in a nominal sense unrelated. If a subassembly must be inspected as a unit, it is treated like a piece part in dealing with multiple characteristics.

The illustrations in Table I have been made ultra simple in order to concentrate on the points involved. Case I might be the inspection of an ordinary nut with characteristic A being a check of the threads with a thread gage and characteristic B being a check of the outside dimensions of the nut in a socket gage. These characteristics are unrelated in the sense that failure of the threads may or may not be accompanied by wrong sized hexagon. Here, it may be desirable to apply the inspection plan to A and to B separately. Then, in case of double sampling only the characteristic failing the first sample would be checked in the second sample. If the sample failed this second trial, the lot should be detailed for the failing characteristic only. This last point should be adhered to whether the lot is detailed by the purchaser or returned to the vendor. Agreement between consumer and producer on this point will go a long way toward keeping these rejected lots intact

when they are returned to the producer for detailing. That is, such agreement will discourage a practice all too common at present of returning rejected lots to the producer's stock bin.

TABLE I: ILLUSTRATIONS OF DISPOSAL OF LOTS ACCORDING TO SAMPLE RESULTS FOR CHARACTERISTICS A AND B UNDER THREE DISTINCT CONDITIONS.

N = 350; n = 70; c = 1. (p_t = 5%, $\bar{p}$ = 1%)

Action on Lot	PIECE PARTS				SUBASSEMBLIES	
	CASE I: UNRELATED CHARACTERISTICS		CASE II: RELATED CHARACTERISTICS		CASE III: SEPARABLE PARTS	
	A	B	A	B	A	B
Accept	1	1	1	0	1	1
Reject	2	1	1	1	2	1

Case II is illustrated by Figure I and shows two major characteristics of a nut coupling. These two dimensions are related because the part will not assemble unless the concentricity of the two meets the drawing requirements. Thus failure of either dimension will reject the part. The acceptance number of one is, therefore, applied to the two characteristics collectively. That is, inspection of the sample can produce not more than one faulty piece, and that piece can fail in only one characteristic.

Obviously this would be an extremely tight acceptance requirement where several dimensions were being inspected. In that case the Quality Engineer must set the lot tolerance per cent defective (p_t), and the process average ($\bar{p}$) at values which are consistent with the average outgoing quality limit (AOQL), which is acceptable in assembly, and the process average which the previous record of first samples shows is descriptive of the vendor's quality.

Case III is quite similar to Case I, but the separability of the components of a subassembly make it worth while to present this third situation. It is illustrated by Figure II in which the connecting tube is readily disconnected from the main unit. Failure of the mechanism in the unit would reject the part, but the tube quality is a separate characteristic. Three conditions of failure to pass inspection are conceivable: (1) unit rejectable, tube acceptable; (2) unit acceptable, tube rejectable; (3) both rejectable. If either (1) or (2) occur for a particular lot, it may be desirable to return only the rejected element to the vendor. This applies particularly if the item is "hot", because it may be possible to assemble acceptable tubes of one lot with acceptable units of another lot, thus providing quick relief of an assembly

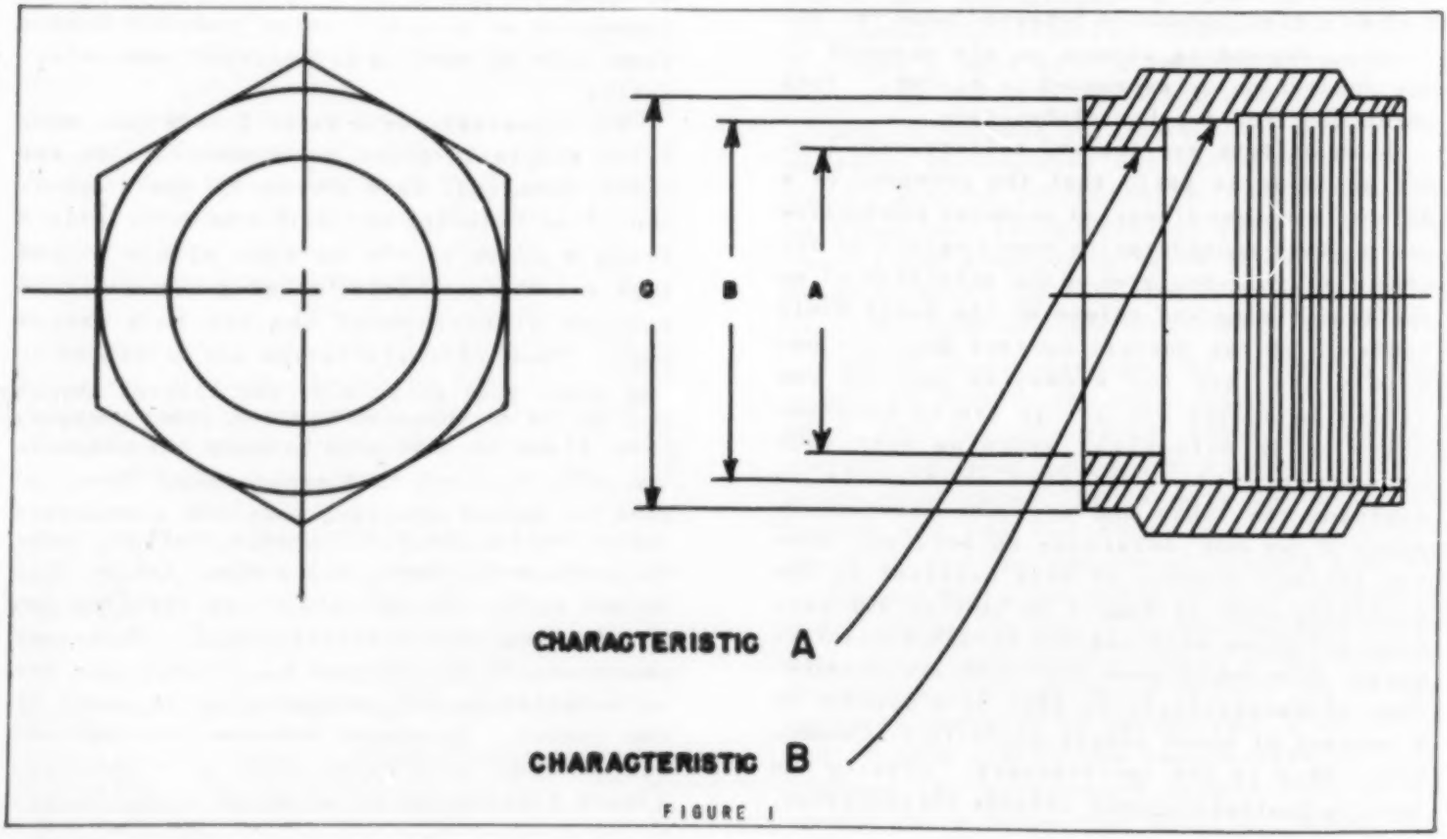

FIGURE I

line shortage. Even though the item is not "hot", retaining the acceptable part of the subassembly may be desirable in order to encourage the vendor to detail and return the rejected element.

Subassemblies which must be accepted or rejected in toto must be treated like Case II. However, it may be desirable to inspect separately for major and minor characteristics. Presumably a higher value of A.O.Q.L. would be used for collective minor characteristics.

The foregoing is intended to be illustrative only, but it gives some idea of the procedures used in receiving inspection at Curtiss-Wright. We have put into practice the sampling techniques outlined, and they appear to solve satisfactorily the previously troublesome problem of dealing with multiple characteristics.

In conclusion, product requirements, and applicable specifications provide the determining criteria for the establishment of sound acceptance sampling procedures. Above all, there must be proper coordination of specification standards in receiving inspection to cover all phases of ultimate product requirements so that material will not be rejected later in assembly departments.

ADDENDUM

In the introduction to "Sampling Inspection Tables", the following statement appears: [1].

"Where, nevertheless, it is desired to include many inspection characteristics at one inspection station, it is sometimes convenient to express quality in terms of defects per unit rather than in terms of per cent defective. In such instances upon converting the scale of the AOQL and lot tolerance values, the tables become generally applicable. For example, an AOQL of 10 per cent can be regarded as 10 defects per 100 units or .1 defect per unit. For this treatment the AOQL values listed in the tables are unaffected whereas the lot tolerance per cent defective values may be affected in some areas of the tables, but to a degree that is usually of no great practical significance."

It should be noted that this usage requires that pieces be inspected for all characteristics regardless of whether defects are found or not. Hence the number of defects recorded is likely to exceed the number of defective pieces. The values of p_t, $\bar{p}$ and AOQL referred to in the quotation must be determined in a given case with this fact in mind.

Quality Control operators should keep in mind that it is not easy to keep inspectors at work on piece parts after the first defect has been found. For this reason alone it may be desirable to adjust lot tolerance and AOQL values for multiple characteristics rather than to shift to "defects per unit". In other cases the finding of one type of defect may affect the tests for other characteristics.

Despite the circumstances mentioned, it may well be that "defects per unit" will be used more commonly in the future in dealing with multiple characteristics.

1. "Sampling Inspection Tables", H.F. Dodge and H.G. Romig, John Wiley and Sons, New York, pp. 4-5.

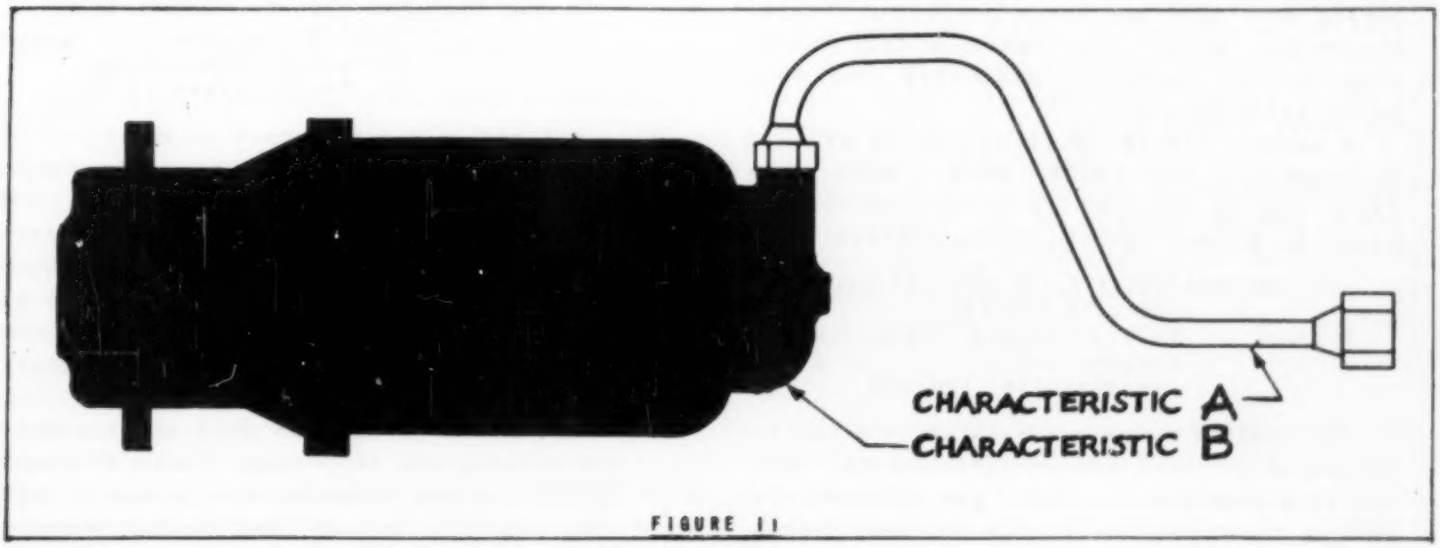

FIGURE 11

SOCIETY REPORTS

THE PHILADELPHIA SOCIETY

Secretary: H. W. Poole, The Brown Instrument Company
Philadelphia, 44, Pennsylvania

The Philadelphia group has been holding meetings at Temple University the third Friday of each month. The meetings are held in Conwell Hall, Room 706, from 7:30 to 9:30 P.M. While the group is small, a number of industries are represented and some very interesting meetings have been held. Persons interested in quality control are cordially invited to attend these meetings. Further information may be obtained from the secretary.

THE STATE UNIVERSITY OF IOWA

Secretary: Lloyd A. Knowler, State University of Iowa
Department of Mathematics,
Iowa City, Iowa

An intensive eight day course in Quality Control by Statistical Methods was held at the State University of Iowa, October 11-19, 1944. Nearly 150 representatives of industry from eight states and officers and employees of the armed forces attended the executive session. Of this number, over 70 registered for the full eight-day course. Many more would have attended had additional facilities been available.

Each of the three follow-up meetings held so far has been well attended and some excellent reports have been made by representatives of industry trained in the techniques of statistical quality control.

Installations have been made in plants having over 5000 employees producing several thousand items per day, and in plants having eight or ten employees producing less than forty items per day.

A second course is scheduled to be held in Iowa City May 16-24, 1945. Nomination forms may be secured by writing Professor Lloyd A. Knowler at the above address.

INDIANA SOCIETY FOR STATISTICAL QUALITY CONTROL

Secretary: Carl G. Schmid, Lukas - Harold Corporation
Indianapolis, Indiana

The Indiana Society was formally organized in December, 1944 and on February 13, 1945, the first meeting was held. The officers are: Harry B. Marsh, Perfect Circle Company, President; Arthur Bender, Delco-Remy, Vice-President; William E. Gibbons, Servel, Treasurer; and Carl G. Schmid, Lukas-Harold, Secretary.

At the all day meeting of February 13, papers covering diversified fields were presented by Harry B. Marsh, Carl G. Schmid, Keith Ross, and Dr. Burr. Messrs. Martin, Boonton, and Stoneburner of the U.S. Rubber Company told of the application of quality control techniques in the manufacture of tire tubes.

The next meeting of the Society will be held April 10 at which Dr. Burr will discuss sampling inspection tables.

PITTSBURGH QUALITY CONTROL SOCIETY

President: John V. Sturtevant, 312 McClellan Drive
Pittsburgh, 10, Pennsylvania

The next meeting of the Pittsburgh Society is scheduled for Saturday, April 14 and will be held in Room 113 Engineering Hall, Carnegie Institute of Technology, Pittsburgh. An informal discussion session is planned from 10:00 A.M. to noon while the regular program will be given in the afternoon session from 1:30 to 5:30 P.M. It is the policy of the Society to discuss all types of statistical methods which find application in the control and improvement of quality in industrial work. Visitors are cordially invited to attend the meetings and to participate in the discussions. For further information please address John V. Sturtevant.

THE ILLINOIS QUALITY CONTROL GROUP

Secretary: John W. Meinhardt, Gaylord Container Corporation
St. Louis, Missouri

Thirty-six men took part in the first continuation meeting of the Illinois group on January 26. Three reports were made. Mr. Nick Kouzmanoff spoke of the start of statistical methods at Microswitch. Mr. Adam Abruzzi discussed an overall quality improvement program at Perfex and Paul L. Hargitt, Sr. told how men and management were sold on quality control at Lucas-Harold.

Dr. Edwin G. Olds of OPRD was a guest at the meeting and at a round table discussion by the men who attended the December intensive course, several interesting comments on

the introduction of statistical methods were brought out.

SOCIETY FOR STATISTICAL QUALITY CONTROL

Secretary: W. B. Rupp, Radio Corporation of America
Harrison, New Jersey

Meetings of the Society for Statistical Quality Control were held at Newark, New Jersey October 16 on the general subject of textiles, December 5 on the general subject of metal trades, and on February 14 on the general subject of quality control problems. Men prominent in each field were the speakers. The next meeting will be held March 29 and will cover the electrical manufacturing field. Future meetings are scheduled for April 25 and May 25.

At the February 14 meeting new by-laws for the society were adopted and officers for 1945-1946 were elected. These men will take office in July: E.H. Mac Niece, Johnson and Johnson Company, President; P.S. Olmstead, Bell Telephone Laboratories, Vice President; W.B. Rupp, Radio Corporation of America, Secretary-Treasurer. The officers and three members at large compose the Executive Committee.

The Newark Society has 101 members. Approximately 300 students have been enrolled in the Statistical Quality Control courses given in the Newark, New Jersey area in 1944-1945. These courses under ESMWT were sponsored by Princeton University. Other courses in the Northern New Jersey area are being conducted under the auspices of Rutgers University and Stevens Institute of Technology.

SYLVANIA ELECTRIC PRODUCTS COMPANY, INC.

J. R. Steen, Manager
Quality Control Engineering

Quality Control, with the complete backing of the management, is a lively topic at the Sylvania Electric Products Montoursville Plant. Although there is no local organization corresponding to Quality Control societies elsewhere, there is a group of men who attended the recent course taught here by Dr. M.A. Brumbaugh and who retain the enthusiasm he aroused.

Our activities have extended beyond mere enthusiasm. We are now in the midst of installing a Quality Control system in our plant. A number of operations are being subjected to statistical examination and control charts have been posted at the machines to increase their availability. An engineer was assigned to Quality Control work and the plant management made it possible for him to attend the Rochester Convention.

The experiences we are going through are quite similar to these encountered in the other plants heard from and we are trying to apply the lessons learned from Dr. Brumbaugh, the Rochester Convention and "Industrial Quality Control."

QUALITY CONTROL ENGINEERS OF ROCHESTER

President: Alfred L. Davis
Bausch and Lomb Optical Company
Rochester, N.Y.

The March 26 meeting was held at the Chamber of Commerce with supervisors and foremen and members of the Industrial Management Council as guests. More than 300 members and guests listened to President Alfred L. Davis of Bausch and Lomb Optical Company outlining plans for coming quality control meetings and to Martin A. Brumbaugh, University of Buffalo speaking on "Quality Control is an Effective Tool of Management."

Dr. Brumbaugh developed the theme that Management's task is to utilize the factors, men, materials, and machines, so as to maximize the quantity of products of marketable quality at minimum cost. The elements of this quadrumvirate are interrelated and Management's job is correspondingly complex. The efficient means of unraveling management's tangled skein is to add a fourth factor, measurements. By controlling quality through analysis of inspection and production records, management acquires sensitive indicators of plant activities that in the absence of these devices are simply a closed book. The result is better quality and greater quantity and at lower cost per unit of manpower, materials, and machine operation.

The presentation was interspersed with illustrations selected to show how use of the control chart procedure actually accomplishes the aims of the efficiency engineers, but does it quietly and with none of the undesirable accompaniments of earlier efficiency engineering.

In the postwar period management will make increasing use of Quality Control results to maintain sensitive contact with operating departments.

NEW DEVELOPMENTS

In this section of each issue is presented one or more new developments in the field of Quality Control

DEVELOPMENT OF REJECT LIMITS FOR MEASUREMENTS

Alfred J. Winterhalter
Colonial Radio Corporation
Buffalo, N.Y.

In the January, 1945 issue of Industrial Quality Control a factor termed "b" was developed for use with the average range of several samples. The product $b\bar{R}$ specifies the reject limits as related to the specification limits. Should the average of a sample fall on the reject limit, the tip of the frequency distribution represented by the sample will just touch the specification limit. Thus only an occasional piece of the distribution will fall outside the specification limit. If the average of a sample falls outside the reject limit, a portion of the frequency distribution will fall outside the specification limit. This portion can be calculated and thus, the percentage of the pieces falling outside of specifications will be known.

The value of "b" is determined from the expression $(\frac{3}{d_2} - A_2)$. The value 3 is used by reason of the specification limit being 3 σ' removed from the $\bar{\bar{X}}'$. If, for example, the specification limit is only 2 σ' from the average, this will result in 2 σ' of the frequency distribution being between the average and the specification limit and the remaining σ' between the specification limit and the tip of the distribution curve. Since 50% of the curve area falls on each side of the arithmetic average of the distribution and as plus (or minus) 2 σ' includes 47.725% of the area of one half the normal curve, the difference between 50% and 47.725% will be the percentage of the curve falling beyond 2 σ' and hence beyond the specification limit. By substituting 2 for the 3 in the expression $(\frac{3}{d_2} - A_2)$ a value for "b" is obtained which positions the reject limits. So with an average of a sample falling on the reject limit, 2.275% of the distribution represented by the sample will fall beyond the specification limit. Figure 1 shows the division of the normal curve area when the specification limit is 2 σ' from the average of the distribution. Also shown is the position of the reject limits as related to the specification limits.

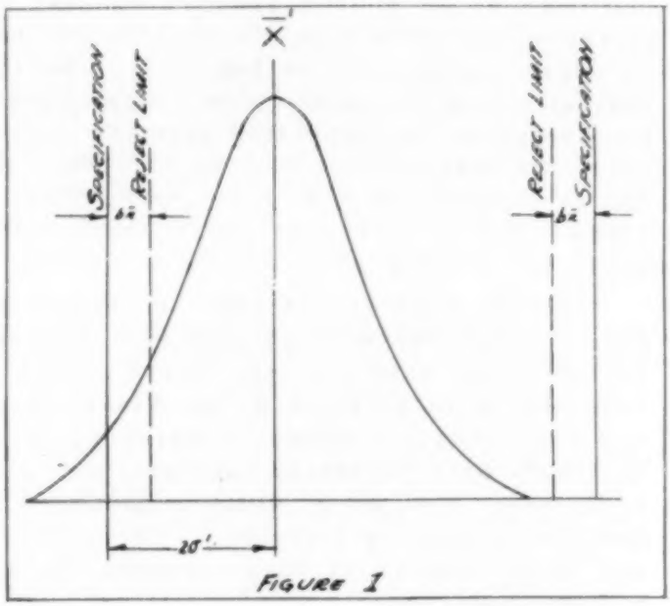

FIGURE 1

By substituting various values of σ' in the foregoing expression, values for "b" may be calculated for use in positioning the reject limits to allow any desired percentage of the

TABLE I: VALUES OF σ' FOR VARIOUS VALUES OF ACCEPTABLE DEFECTIVES

ACCEPTABLE DEFECTIVES ROUNDED %	ACTUAL %	PERCENTAGES OF THE TOTAL FREQUENCIES BETWEEN $\bar{\bar{X}}$ AND THE GIVEN VALUES OF σ'	VALUES OF σ'
0.0	.1350	49.8650	3.00
0.5	.4940	49.5060	2.58
1.0	.9993	49.0097	2.33
1.5	1.5003	48.4997	2.17
2.0	2.0182	47.9818	2.05
3.0	3.0054	46.9946	1.88
4.0	4.0059	45.9941	1.75
5.0	4.9987	45.0013	1.645
10.0	10.0273	39.9727	1.28

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distribution represented by the samples to fall outside the specification limits. These percentages are acceptable defectives.

As an aid in selecting proper values of σ', Table I is presented. The percentage of the total frequencies between $\bar{X}'$ and the stated value of σ' is obtained from a table of areas of the normal curve.

Calculation of the expression $(\frac{3}{d_2} - A_2)$ when the values of σ' given in Table I are substituted for the 3 will give values of "b" as a function of lot tolerance defective. When values of d_2 and A_2 (which are a function of sample size and may be obtained from a table of factors for computing three sigma control limits) are varied, values of "b" as a function of sample size are obtained. The results of these calculations are shown in Table II.

An example will illustrate the use of Table II. It is decided that a lot of material is acceptable if not more than 1% of the pieces are outside of the specification limits. These specification limits are 1.500 to 1.540 inches for a certain dimension. Measurements of three random samples of five pieces each give averages of 1.511, 1.514, 1.513 inches and ranges of .021, .020, and .024 inches respectively.

The average range is .022 inches. Entering Table II at a sample size of five and a p_t of 1.0%, a value for "b" of .425 is obtained. The product of $b\bar{R}$ is .009. This product when added to the lower specification limit and subtracted from the upper specification limit gives 1.509 and 1.531 for the lower and upper reject limits, respectively. The averages of all three samples are within the reject limits and the lot is acceptable.

The information obtained during the measurement of the above samples may be used to estimate the percent defective of the lot. Entering Table II at a sample size of five again and this time at the next lower value of p_t (0.5), a value for "b" of 0.532 is obtained. With these factors, lower and upper reject limits of 1.513 and 1.528 are calculated. The lot is between 0.5% and 1.0% defective since the average of one sample is outside the reject limit. As the average of the one sample is just outside the lower reject limit and the average of the remaining samples are within, the lot is slightly more than 0.5% defective by reason of pieces being outside the lower specification limit.

TABLE II: VALUES OF "b" AS A FUNCTION OF SAMPLE SIZE FOR VARIOUS VALUES OF ACCEPTABLE DEFECTIVES

SAMPLE SIZE	ACCEPTABLE DEFECTIVES								
	0	0.5	1.0	1.5	2.0	3.0	4.0	5.0	10.0
4	.728	.624	.403	.325	.267	.184	.121	.070	-.107
5	.713	.532	.425	.356	.304	.231	.175	.130	-.027
6	.701	.535	.436	.373	.326	.259	.208	.167	.022
7	.690	.535	.443	.384	.339	.276	.228	.189	.054
8	.681	.533	.445	.389	.347	.287	.242	.205	.077
9	.673	.532	.448	.394	.353	.296	.252	.217	.094
10	.667	.530	.449	.397	.358	.303	.261	.226	.108
11	.660	.528	.449	.399	.361	.307	.266	.233	.118
12	.655	.526	.449	.400	.363	.311	.271	.239	.127
13	.650	.524	.449	.401	.366	.315	.275	.244	.135
14	.646	.522	.449	.402	.367	.317	.279	.247	.140
15	.641	.520	.448	.403	.367	.318	.281	.251	.145

BUFFALO MEETING

The Society of Quality Control Engineers held a technical session at the University of Buffalo Monday evening, March 12th. More than 100 members and guests gathered to hear a presentation of the quality control system of the characteristics of binoculars employed at Bausch and Lomb Optical Company of Rochester.

Richard Eisenhart, Chief Inspector in the Optics Section presented the organization plan of the Company. He stressed the advantages that have resulted from an organization change which has separated bench inspection from production and placed inspection supervision on the same level with production supervision. Both now report to the General Superintendent.

Joseph Warren, Assistant Chief Inspector in the Mechanical Section presented the problem of control of the mechanical components of the binocular. He showed measurement control charts telling the before and after story of their work. By charting the high level of scrap and rework and persuading production to change their methods, the product variability was brought into agreement with drawing tolerances. At first, production supervisors were rather reluctant to put into effect recommendations of the quality control group, but a few successful improvements changed this attitude.

Edward Close, Assistant Chief Inspector in the Mechanical Section explained the work that was done to improve the functioning of the binocular by correcting the mislocation of fixtures used to hold the instrument rigid during machining. The corrective action was obtained through the use of measurement charts. It is interesting to note that allowance had to be made for error in the holding fixtures. Accordingly adjustments were made to some fixtures and others were replaced. By making allowance for this fixture variability, it is possible to control the variability of the dimensions of the components of the binocular. Both Mr. Warren and Mr. Close stressed the saving of man-hours and the increase in production that have resulted from lower scrap and less rework.

William Bidlack, Assistant Chief Inspector in the Optics Section, discussed the complicated problems of control of optical characteristics of the binocular prism. Analysis of operating methods, changes in ways of doing things, and the development of worker cooperation have been the chief improvement devices. However, the time is at hand when sufficient measurement information is available to permit the introduction of control charts. Perhaps the biggest saving thus far has come from better centering of prisms in the grinding and facing fixtures.

Alfred Davis, Chief Inspector in Mechanical Section explained their method of making scrap, salvage, and rework cost available quickly through the use of mechanical tabulation equipment for keeping records. The record of rejections is sent to the Cost Accounting Department daily. Standard costs are applied and the whole record is transferred to tabulating cards. A tabulated cost of rejections becomes available to Management within a few days after the end of the week. Formerly this report came out six weeks late; the scrap costs were a dead issue, and action, if taken at all, was ineffective. Now Management's reaction is decisive and immediate.

TOP MANAGEMENT VIEWS QUALITY CONTROL

(Continued from Page 5)

As we look into the future, when our individual enterprises will have lost the biggest customer they have ever had, the Federal Government, the obstacles in the way of self-preservation will be increasingly complex. We will have not only more keen and effective competition from many new concerns in our own country, but foreign manufacturers will be eager to sell more of their products in this country. Top management of successful enterprise in this country will be faced with tremendous competitive conditions, and yet I am sure that with top management viewing its obligations comprehensively, effectively and thoroughly, our American System of Free Enterprise can continue in a world concerned with the new concept of internationalism. This can be done, however, only through effective utilization of the available tools of management and among these the contributions of quality control must be received with enthusiastic approval.

ROCHESTER CLINIC

The program of the first Rochester Clinic was presented in the January issue of INDUSTRIAL QUALITY CONTROL. At the noon luncheon over 300 quality control devotees gathered to hear Mr. M. Herbert Eisenhart, President of Bausch and Lomb Optical Company, explain how "Top Management Views Quality Control." Mr. Eisenhart's able address is reproduced on earlier pages of this magazine.

At the close of the luncheon all of the assembled group adjourned to the clinics, nine of which had been arranged to discuss as many phases of quality control procedure. The chairman of each clinic presented at the beginning an outline statement of the subject matter of the clinic and threw in some open questions calculated to stimulate the discussion period which followed. This plan proved successful in each clinic, with the result that nine most constructive forums were held during the afternoon. To report these activities completely would require more space than is presently available. Accordingly what follows is merely a partial summary of the conclusions reached in the several clinics.[1]

CLINIC I

Subject: Installing a Quality Control System.

Chairman: George V. Herrold, Chief Inspector, Colonial Radio Corporation, Buffalo, New York.

A quality control system should be installed gradually. The Colonial system was started with control of sub-assembly operations. The steps must inevitably be taken slowly while operators, foremen, inspectors and supervisors become accustomed to the presence of control records and become familiar with control chart procedure. The results from the first installation should be presented to management as a basis for extension of the system. This is a critical stage because failure to convince management at this point will impede or even prevent further development. At Colonial expansion from sub-assembly control was gradual into final assembly and testing, receiving, and machine shop. At each step it was possible to demonstrate savings far in excess of the costs incurred.

A training program should be started early. The exact form which this program will take depends upon conditions in a given plant; particularly upon the person or persons available to give the instruction and the organization plan of the plant. But the training should include operating supervision and operators on one hand, and management supervision on the other.

It is highly essential that the Quality Control Engineer in charge of the system should weigh carefully the consequences of each step in his program. One unsound move can easily be fatal to his future progress. Presumably the man in charge of a quality control program should be a trained engineer, although long time familiarity with plant engineering practice may be an acceptable substitute.

CLINIC II

Subject: The Function of Statistics in Process Quality Control.

Chairman: Edwin G. Olds, Chief Statistical Consultant, Office of Production Research and Development, War Production Board, Washington, D. C.

A controlled process is predictable; an uncontrolled process is wholly unpredictable. The entire basis of maintaining dimensions within tolerances in production is the establishment of a state of control at a satisfactory level. The method of doing this is through the control chart with its statistical limits and the accompanying statistical application in determining whether the natural tolerance of the process is consistent with the drawing tolerances of the engineer. The result of the statistical work may be a confirmation of the process as it is; more likely corrective action to achieve control and reduce the natural tolerance may be indicated, or an adjustment of the engineering limits may be in order. Whatever the particular circumstances, this sequence of analytical steps

1. The Industrial Management Council of Rochester has prepared a detailed mimeographed report of the clinics. This report can be obtained by writing to Mr. David Crockett, Manager, Industrial Management Council, Chamber of Commerce Bldg., 55 St. Paul Street, Rochester, New York.

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is simply a closed book without the control chart procedure.

The effectiveness of a control system depends entirely upon the soundness of the chief operator. A good engineer who is willing to acquire a modest amount of statistical knowledge has a better chance of succeeding than a good statistician who lacks practical engineering knowledge. A control system should be closely allied to the engineering department, although it may be preferable to have the authority of the control function stem directly from head management rather than through the head of the engineering department. The precise mechanics of authority must be adopted to a particular concern's organizational plan. There is no generally applicable rule.

CLINIC III

Subject: Single Versus Double Sampling for Acceptance Inspection.

Chairman: John W. W. Sullivan, Hill and Knowlton, New York, New York; Formerly Chief of Inspection, Industrial Division, Cleveland Ordnance District.

Double sampling is in general more economical than single sampling. Specifically, however, the decision to use double sampling must be made in terms of the available space in the receiving area, the additional time that lots are held in receiving, the available inspection staff (particularly important, if rejected lots are returned to the vendor for detailing), the attitude of inspectors, the difficulty of selecting random samples, the complexity of the inspection operation.

The operating characteristic of single sampling differs from that of double sampling. Also the relationship between the operating characteristic of the two plans depends upon whether a plant's acceptance inspection is based on Lot Quality Protection or Average Quality Protection.

When Lot Quality Protection is used, double sampling gives better protection to the producer when good quality lots are offered; double sampling will accept a higher percentage of lots of quality better than the lot tolerance fraction defective; single sampling gives no better protection to the consumer than does double sampling when poor quality lots are offered.

When Average Quality Protection is used, double sampling gives better protection to the producer when good quality lots are offered and better protection to the consumer when poor quality lots are offered. Single sampling will require more inspection than double sampling for good quality lots, while single sampling will require less inspection than double sampling for poor quality lots.

Do not improvise sampling plans. Follow the sample sizes and acceptance numbers of an established plan. Improvised plans shift the risks of both acceptance and rejection, and result in loss of the most economical sample size.

CLINIC IV

Subject: Quality Control as a Cost Reduction Instrument.

Chairman: James Walker, General Electric Company, Erie, Pennsylvania.

Savings come from a higher percentage of marketable product from a given amount of raw material, machine-hours, and man-hours. The sequence of action is first to recognize trouble, second to analyze the difficulty with the aid of frequency distributions and control charts and third to take corrective action. The third step usually requires joint action of production and engineering. For example, an automatic screw machine was turning out 62 per cent scrap; control chart analysis showed that the machine was not capable of holding the drawing tolerance. The machine was rebuilt; the next 15000 parts produced contained only 23 rejects.

Quality control should be introduced into a plant by selecting initially an operation which is causing trouble but which will not involve too much complication in getting corrective action. Move from simpler cases to more involved ones as more experience is gained.

In a job shop use the control chart to classify machines according to the tolerances they are capable of holding. Allocate job orders to machines according to this classification.

This clinic discussed the relation of quality of product to wage payment plans. They concluded that labor contracts should be written so that the rates apply to marketable product. In particular, where a piece rate is in effect, the machine operator should

be charged with defective work when the fault originates with him.

CLINIC V

Subject: Application of Control Charts to Screw Thread Problems.

Chairman: Richard W. Coolbaugh, Assistant Chief Inspector, Easy Washing Machine Company, Syracuse, N.Y.

Control charts can be used to determine the following: (1) what can be expected from each machine, (2) whether the natural tolerance of a machine is satisfactory to produce the class of thread desired, (3) the progressive variation of critical dimensions, (4) the natural variation of the inspection system. The gaging points to be controlled are pitch diameter, major diameter, minor diameter, lead and thread angle. Precision gaging is required. Major diameter can be measured with a micrometer, minor diameter with a comparator, lead with a comparator, and thread angle with a shadow graph or comparator.

Pitch diameter and lead error are the two most important characteristics of screw threads and they are the most likely sources of trouble. Variations in pitch diameter are dependent upon lead error. Therefore the reduction of lead error to a minimum is the first requisite of thread control. Lead error may be caused by the lead screw, by back lash in the gears, by varying frictional resistance, by variations in line center of the set-up and threading tool, by chip breaking, by improper grinding on chasers or tap.

The next step is to evaluate inspector and gage precision. This is done by measuring the variability of results of repeat measurements of the same piece for inspectors and the constant checking of line gages with laboratory controlled masters. Control charts for maintenance of pitch diameter can then be set up with control limits adjusted for lead error, gage repeat error and inspector error.

Screw thread control requires a thorough knowledge of thread fundamentals and thread inspection methods. Troublesome thread production problems must be analyzed by precision inspection equipment. Production can then be followed by the use of control charts set up in comparative units of the related characteristics involved.

CLINIC VI

Subject: Quality Control Through Gage Control.

Chairman: Clifford A. Wallace, Superintendent of Quality, Camera Works, Eastman Kodak Company, Rochester, New York.

Control charts based on inaccurate inspection records are worthless. Such inaccuracies are of two kinds: those in which the inspector is at fault, and those in which the inspection equipment is at fault. Gage control, therefore, is a fundamental of quality control. A definite program for control of accuracy of gages is as important to the quality department as is the production scheduling department to the production department. The gage program must provide for checking of all instruments and equipment at sufficiently frequent intervals to insure accuracy. For most line equipment this means checking at the end of each shift.

Any concern that expects to do precision work should consider the desirability of establishing a gage laboratory. Such a laboratory can be set up for about $35,000 and will pay for itself in quality of product even in a plant of moderate size.

This clinic brought in a concrete proposal that a separate committee of the Rochester Quality Control Engineers should be established for the discussion of gage control problems.

CLINIC VII

Subject: Recent Developments In Gaging Practice.

Chairman: Chauncey G. Newton, Manager, Small Tool and Gage Department, Pratt and Whitney Company; Chairman, Rochester Chapter, American Society Tool Engineers, Rochester, New York.

World War II has produced a new attitude toward gaging. The old idea of "necessary evil" is now replaced by constructive recognition of the inherent value to a plant of adequate inspection. The control feature of inspection has encouraged management to install the proper gages, to provide for gage control, and to standardize gaging procedure. Such standardization has led to the use of the proper gaging equipment and provision of instruction in the reading of measurement gages.

The problems of maintenance of the accuracy of fixed gages led to a discussion of the desirability of maintaining a certified set of gage blocks as a part of the equipment of

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a gage testing laboratory. Emphasis was placed on the general tendency to replace fixed gages with indicating gages. Two primary advantages explain this trend. The indicating gages have higher initial cost, but their longer life and lower maintenance cost make them cheaper in the long run. The measurements produced by the indicating gage permit sensitive reading of variability of dimensions and allow the Quality Engineer to detect with the aid of the control chart the entrance of extraneous factors which lead to scrap, rework, and repair.

CLINIC VIII

Subject: Methods of Reporting Quality Performance to Management.

Chairman: William A. Kerr, General Sales Manager, Spencer Lens Company, Buffalo, New York.

There are too many cases in which management does lip service to quality control methods, but does not go to the trouble of discovering what a powerful tool of management the control procedure really is. In the long run, this attitude will be fatal to a quality control system and in some cases there is not much that can be done to make management aware of the possibilities of control chart analysis. In most cases the support of management can be obtained by effective reporting of results obtained.

Reports of the Quality Engineer to his immediate superior should be in the language of the control procedure in operation. The same applies to reports circulated among the operating supervision staff, including Engineering. However, in every plant there is a management level above which quality results must be summarized and the emphasis must be shifted from detailed quality results to overall quality status. It is quite likely that emphasis should also be shifted to dollar savings.

Detailed quality reports go to technical supervision, summary reports go to administrators. There is a broad rule: Send to anyone in a management position a report in the form needed for him to take action of the type which his office authorizes.

The following specific subjects were discussed: The use of a demerit system for combining defects in a summary report of the quality status of finished products or for cost evaluation, a rating scheme for evaluating the quality of work done by subcontractors. Management reports must reach their destination as quickly as possible, establish a regular schedule for issuing reports and then adhere to your schedule. Quality Engineers must prepare their reports with full understanding of the character and personality of the individual of management to whom the report is addressed. Hence good judgment is more important than rules in determining the form and content of management reports.

CLINIC IX

Subject: Role of Inspection in Development of New Product.

Chairman: Eugene L. Grant, Stanford University, Palo Alta, California.

Inspection makes four constructive contributions to the development of new products: (1) Inspection records on pilot production provide to design engineers knowledge on which to base product improvement, (2) Analysis of inspection records shows comparative economy of alternate designs, (3) Inspection records give information concerning the natural tolerances of machines and their availability for particular jobs, (4) Inspection aids in the education of research and development groups.

This clinic recommends that in every plant attention should be given to the problem of breaking down the barriers between inspection, design, and production. The clinic offers the committee system of resolving disputes and suggests that the Quality Control Engineer with his objective records is an indespensable member of the committee.

EVENING SESSION

A very complete gage exhibit was displayed in the interval between the close of the clinics and the evening dinner. At the dinner, the assembled guests heard Lewis B. Swift, President of Taylor Instrument Company speaking as Chairman of the Industrial Management Council comment on the afternoon activities. Martin A. Brumbaugh of the University of Buffalo summarized the discussions of the afternoon and the conclusions reached by the clinics. George D. Edwards, Director of Quality Assurance, Bell Telephone Laboratories was the speaker of the evening with the subject, "The Future of Quality Control".

CURRENT PUBLICATIONS AND BIBLIOGRAPHY

A page of each issue of the Journal is devoted to brief reviews of articles on Statistical Quality Control appearing in current publications. Earlier issues of the Journal contain bibliographies of materials published in former years. The purpose is to provide readers with a permanent reference list. In compiling this historical list omissions are inevitable. Assistance from readers by supplying missing references will be appreciated.

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NOTES

Richard Coolbaugh, Assistant Chief Inspector, Easy Washing Machine Company, Syracuse, N.Y. is conducting an evening course in Quality Control Technique at Syracuse University under E.S.M.W.T. auspices.

Dr. Edwin G. Olds, Chief Statistical Consultant, Office Of Production Research and Development, War Production Board, visited plants in the Buffalo area February 23 and 24, following similar visits in Syracuse and Rochester earlier in the week, including participation in the Rochester Clinic, February 20.

Martin A. Brumbaugh spoke on Quality Control at the March 7 meeting of the Niagara Frontier Industrial Engineering Society.

Prof. Harry Loberg, Cornell University, is conducting Quality Control classes at Curtiss-Wright Aeronautical Corporation, Buffalo Plant.

The eight day intensive courses in Quality Control of the Office of Production Research and Development are going forward. The course at Ohio State University, February 7-15, had 116 students in attendance for the eight days and nearly twice that number at the Executive Session. The course at Northwestern University, March 14-22, is about to start as this is being written. The next course is scheduled at University of Iowa, May 16-24.

At the Rochester Clinic, February 20, three life memberships were awarded in the Rochester Quality Control Society. The recipients were M. Herbert Eisenhart, President, Bausch and Lomb Optical Company, Rochester; George D. Edwards, Director of Quality Assurance, Bell Telephone Laboratories, New York; and Martin A. Brumbaugh, University of Buffalo.

Miss Bernice Cohen recent graduate of the University of Buffalo is now employed as statistician in the Quality Control Department of Colonial Radio Corporation.

Alfred J. Winterhalter of Colonial Radio Corporation will address the Newark Society For Statistical Quality Control at their March 29 meeting. The subject of Mr. Winterhalter's talk is "The Installation of a Quality Control System". Enoch B. Ferrell, of Bell Telephone Laboratories will also speak and has for his subject, "Control Chart Analysis of Performance During Life". Ralph E. Wareham, Director of Quality Control, General Electric Company is the meeting Chairman and four men, prominent in the electrical field have been selected as leaders for the discussion period.

INDUSTRIAL QUALITY CONTROL

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